PATENT CLAIMS

1. Method for controlling the combustion process in a combustion engine (1), comprising at least one cylinder (2), at least one piston (3), which reciprocates in the cylinder (2) and is set to reverse in the cylinder (2) at an upper and lower dead centre position, and at least one fuel feed device (13), which is disposed in the cylinder (2) and through which fuel or a fuel mixture is injected directly into the cylinder with high kinetic energy such that the fuel or the fuel mixture, on its way into the cylinder (2), forms a spray and is mixed with cylinder gas compressed in the cylinder (2) forming a fuel/gas mixture, which is ignited by compression heat generated in the cylinder (2) only after an at least local mixing of fuel and cylinder gas has occurred, characterized in that the spray, during the injection process, supplies kinetic energy and controls a spray-internal mixing process between the fuel, or the fuel mixture, and the cylinder gas, and supplies kinetic energy to a large-scale global mixing process, and in that, as a result of the motion and/or design of the piston, further kinetic energy is supplied to the spray-internal and to the global mixing process.

2. Method according to Claim 1, characterized in that the soot and nitrogen oxide (NOx) emissions generated during the combustion process and the efficiency of the engine (1) are controlled essentially independently of each other in that the soot emissions are primarily controlled by the quantity of supplied kinetic energy to the mixture and the nitrogen oxide emissions are primarily controlled by the quantity of exhaust gases from earlier combustion processes and the efficiency is primarily controlled by the centre of gravity in the combustion chamber and the duration of the heat release.

3. Method according to either of Claims 1 or 2, characterized in that the gas compressed in the

cylinder (2) contains, for an optional quantity of nitrogen oxide emission, a certain proportion of exhaust gases from earlier combustion processes and which have been recirculated to the cylinder in accordance with a variation in the oxygen content from approx. 21% down to approx. 15%.

4. Method according to any of the preceding claims, characterized in that the injection pressure of the fuel feed device (13) is higher than 300 bar, preferably between 1000 and 3000 bar.

5. Method according to any of the preceding claims, characterized in that the injection pressure is controlled such that it varies during the injection of the fuel or the fuel mixture into the cylinder (2).

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6. Method according to any of the preceding claims, characterized in that the fuel or the fuel mixture is injected such that the fuel or the fuel mixture, at the start of the injection, is injected at the maximum pressure generated during the whole of the injection.

7. Method according to any of the preceding claims, characterized in that, as a result of the motion and design (29) of the piston (3), kinetic energy is supplied, during the expansion phase, to the large-scale global mixing process.

8. Method according to any of the preceding claims, characterized in that the fuel or the fuel mixture is injected through nozzles of round, elliptical or other suitable shape approx. 0.05-0.40 mm, preferably approx. 0.1-0.25 mm, in size.

9. Method according to any of the preceding claims, characterized in that injection of the fuel or the fuel mixture into the cylinder (2) is begun, when applied to a combustion engine with crankshaft, at a crankshaft angle of approx. 20° before to approx. 20° after the upper dead centre position.

10. Method according to any of the preceding claims, characterized in that the mixing is carried out locally, since fuel or the fuel mixture and the cylinder gas are mixed in regions upstream of the

regions in the spray where combustion takes place and since the injection continues after ignition has been realized.

11. Method according to Claim 10, characterized in that the local mixing during the injection period is controlled by the distance between the fuel injector nozzle (13) and where the fuel/gas mixture principally burns and in that this distance is controlled by the kinetic energy and the turbulence in the spray and the shape of the spray which leaves the fuel injector nozzle (13) and by the content of exhaust gases in the cylinder (2) which is recirculated to the cylinder (2) from earlier combustion processes.

12. Method according to any of Claims 1 to 9, characterized in that the mixing is carried out globally since essentially the entire quantity of fuel corresponding to one combustion cycle is injected and mixed in the cylinder (2) before ignition and combustion are realized.

13. Method according to any of the preceding claims, characterized in that the gas motion is formed by the gas present in the cylinder (2) being forced out through a gap (21) between the periphery of a piston top (8) and one end of the cylinder (2), when the piston (3) is in the upper dead centre position.

14. Method according to any of the preceding claims, characterized in that a swirl motion is generated in the cylinder (2).

15. Method according to any of the preceding claims, characterized in that further kinetic energy to the mixture is supplied through a post-injection.